# The Dynamical Life of Interstellar Filaments

### The role of gas dynamics, stellar feedback and chemistry

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## In Short

- Stars form in dense prestellar cores that are deeply embedded in gas filaments.
- The condensation of cores out of and their (dynamical) connection to the filaments is not well understood.
- We study the role played by various dynamical processes (chemistry, turbulence, magnetic fields, stellar feedback etc.) on the evolution of filaments and cores within these.
- We use high-resolution numerical simulations achieving resolutions of a few AU.
- Following the chemistry will allow us to compare with recent observations by e.g. *ALMA*, *Herschel* or *APEX*.


Star formation occurs in dense pre-stellar cores, small gravitationally bound objects that are deeply embedded in interstellar filaments. The formation of the parental filament, as well as the condensation of cores out of these is a highly complex phenomenon. The gas dynamics is controlled by many physical processes, such as magnetic fields, turbulence, heating and cooling, radiation and (self-)gravity. The non-linear coupling of these processes requires robust, highly resolved numerical simulations to study the detailled time evolution of all relevant quantities.
In this project, we aim to investigate the time evolution of isolated interstellar filaments subject to varying initial conditions [1], which were shown to have a strong impact on the resulting star formation efficiency of the filaments as well as on the mode of gravitationally collapse (centralised vs. edge-on). Fig. 1 gives an example of varying initial conditions on the resulting morphology of filaments. In this example, the turbulent integral scale has been varied by a factor of ten.
In a second step, we will model the chemical evolution of such entities by employing the chemistry package *KROME* [2], which has already been used in our context for a similar study of deuteration in filaments [3] and cores [4].
Lastly, we will include radiative feedback from the formed protostars, which is based on a hybrid characteristics method [5]. The combination of all physical ingredients (turbulence, magnetic fields, chemistry, star formation and stellar feedback) thus enables us to study the life cycle of interstellar filaments in great detail. A comparison with recent observations will be achieved by producing synthetic intensity maps and spectra with the *POLARIS* radiative transfer code [6].

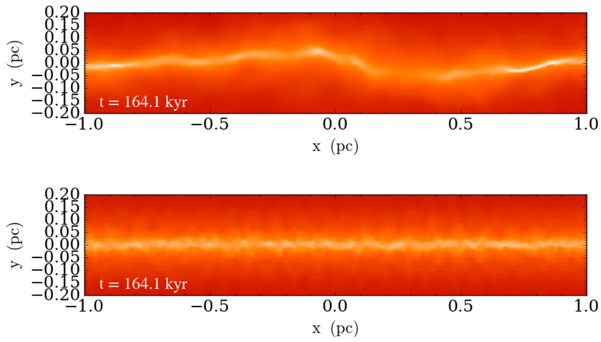


***Figure 1:** Surface density maps of two simulated filaments. The initial magnetic field is directed along the y-axis and the Mach number is unity. The difference between these two filaments is the integral scale of the turbulent fluctuations at the beginning. For the upper filament, the integral scale is about one pc, while for the lower it is about a tenth of a pc. The morphological differences, as well as differences in the surface density are clearly seen.*

## WWW

https://www.hs.uni-hamburg.de/index.php?option=com_contact&view=contact&id=32&Itemid=217&lang=de

## More Information


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[3] B. Körtgen, S. Bovino, D. Schleicher, A. Stutz, R. Banerjee, A. Giannetti, S. Leurini *MNRAS* **478** 95-109 (2018) doi:10.1093/mnras/sty993

[4] B. Körtgen, S. Bovino, D. Schleicher, A. Giannetti, R. Banerjee *MNRAS* **469** 2602-2625 (2017) doi:10.1093/mnras/stx1005

[5] L. Buntemeyer, R. Banerjee, T. Peters, M. Klassen, R. Pudritz *New Astronomy* **43** 49-69 (2016) doi:10.1016/j.newast.2015.07.022

[6] S. Reissl, S. Wolf, R. Brauer, *A&A* **593** 17 pp. (2016) doi:10.1051/0004-6361/201424930

## Project Partners

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